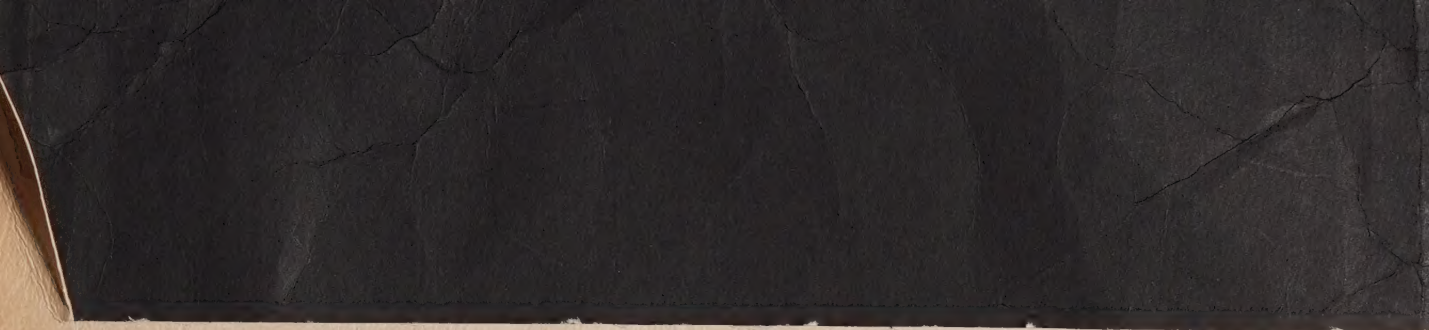


COMMUNICATION ELECTRONICS, INC.

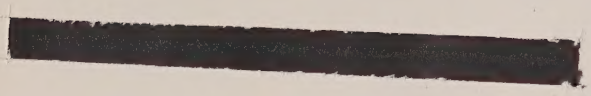
6006 EXECUTIVE BOULEVARD ROCKVILLE, MARYLAND, 20852

INSTRUCTION MANUAL

FOR

TYPE IFD-4000C IF DEMODULATOR

COMMUNICATION ELECTRONICS, INC.
6006 EXECUTIVE BOULEVARD
ROCKVILLE, MARYLAND, 20852



WARNING

This equipment employs voltages which are dangerous and may be fatal if contacted. Extreme caution should be exercised in working with the equipment with any of the protective covers removed.

INTRODUCTION

The Types IFD-4000B and IFD-4000C IF Demodulator Modules are electrically and mechanically identical units. The suffix letter was advanced so that the suffix letters on the plug-in modules would agree with the suffix letter on the associated demodulator main chassis. The IFD-4000B instruction manual has accordingly been furnished with the IFD-4000C and this manual is entirely applicable. All references to the IFD-4000B should be interpreted to read IFD-4000C.

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Table 1-1. Type IFD-4000B IF Demodulator, Specifications

Types of Reception	AM, FM, and CW
Center Frequency	21.4 mc
Dynamic Range	From noise up to 100 mv using AGC or manual gain control
Bandwidth	4 mc ±800 kc
Distortion	AM: 5%, maximum, when modulated 30% at 1 kc rate FM: 5%, maximum, when modulated at 1 kc with 1.6 mc deviation
Spurious Response	Response falls off smoothly to 60 db down without abrupt discontinuities or amplitude inversions
Input Impedance	50 ohms; VSWR 1.5 to 1, maximum
Types of Gain Control	Normal (AGC), tracking or manual
Normal Gain Control	Internal AGC circuit maintains output level within 3 db over an input signal level range from 1.24 mv to 0.1 volt. The AGC will respond to signal variations up to 3 cycles and roll off at approximately 12 db per octave. The AGC will hold the second detector output level to approximately 1 vdc on CW signals.
Tracking Gain Control	Module gain controlled by an external high performance pulse-type AGC.
Manual Gain Control	A manual gain control is provided which will vary the gain from maximum to 60-db below maximum.
Stability with Normal (AGC) Gain Control	The center frequency will not change more than ±10% or the bandwidth by more than ±5% over the AGC range.
AGC Voltage Gain	Approximately 30 db.
FM Output Stability	Output varies less than 6 db for an input signal level change of 60 db.
Beat Frequency Oscillator	Internal 21.4 mc BFO; adjustable ±10 kc from demodulator main chassis. The BFO is stable to 100 cycles per minute at a constant temperature.
Video Output Bandwidth	500kc, 1mc, or 2mc, selectable by front panel switch
Video Amplifier	Video amplifier will drive a 93-ohm load up to the maximum level of the video (AM or FM).
Pre-detection Output	A 21.4 mc pre-detection output will provide 10 mv, minimum. This output will exhibit all AGC characteristics and will work into a 50-ohm load.
Shape Factor (60 to 6 db)	7.5 to 1
Ripple Across Pass Band	2 db, maximum
Input Power	+12 vdc at 108 ma, maximum, and -12 vdc at 50 ma, maximum
Size	4.5-inches high, 2.25-inches wide, and 13-inches deep.
Weight	2.75 lbs., approximately

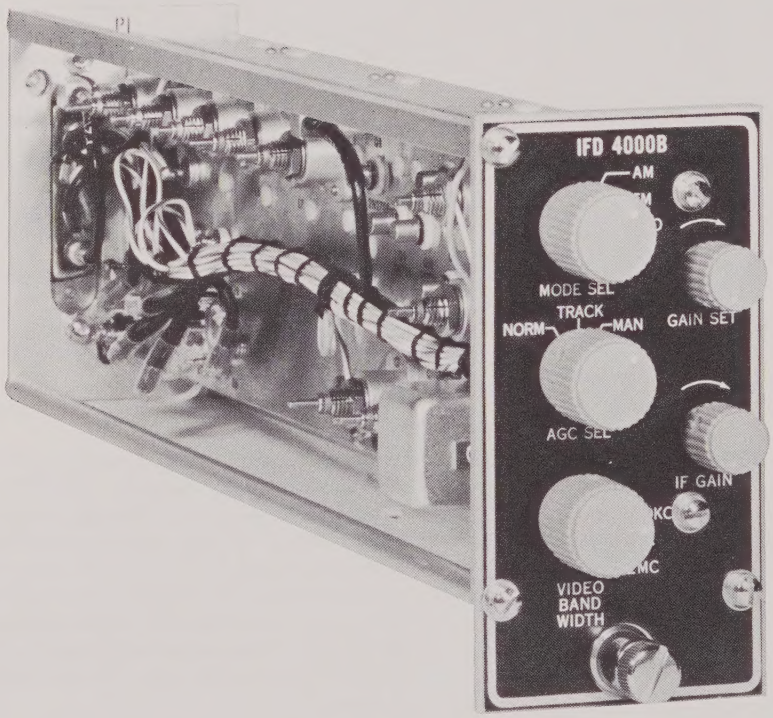


Figure 1-1. Type IFD-4000B IF Demodulator, Front View

SECTION I

GENERAL DESCRIPTION

1.1 ELECTRICAL DESCRIPTION

The type IFD-4000B IF Demodulator is designed for the reception of AM, FM, and CW signals from a 21.4-mc IF signal input. This unit plugs-in the type DM-4B Demodulator main chassis which furnishes the 21.4-mc input signal. The bandwidth of the IFD-4000B is 4 mc. The bandwidth of the video output can be set to 500 kc, 1 mc, or 2 mc, by a front panel switch. Operating voltages, signal inputs, and signal outputs are connected to the unit from the DM-4B Demodulator module. Three signal inputs are normally furnished from the DM-4B to the IFD-4000B; a 21.4-mc IF input; a BFO tuning voltage input; and a tracking AGC voltage input. The IFD-4000B provides five signal outputs to the DM-4B; a tuning meter voltage output; a video output; a 21.4-mc pre-detection output; a signal strength voltage output; and a tracking video output. Solid state components are used exclusively in the design to provide high reliability and low power consumption. Pertinent specifications for the IFD-4000B are presented in Table 1-1; the transistor complement is presented in Table 1-2.

1.2 MECHANICAL DESCRIPTION

As shown in Figure 1-1, the front panel of the IFD-4000B mounts the MODE SEL switch, AGC SEL switch, VIDEO BANDWIDTH switch, the GAIN SET, and IF GAIN controls.

1.2.1 All inputs and outputs for the module are accomplished through the 15-pin Cannon connector on the rear apron of the module.

1.2.2 The main chassis and front panel are constructed of aluminum. The front panel is grey with an overlaid black-anodized etched plate. The IF chassis is constructed of brass, which is silver-plated and gold-flashed to prevent tarnishing. Located within the chassis are four etched printed circuit boards which contain the components for three video amplifiers and an AGC amplifier.

Table 1-2. Type IFD-4000B IF Demodulator, Transistor Complement

Ref. Desig.	Type	Function
	Main Chassis	
Q1	2N2708	IF Amplifier
Q2	2N706	BFO
Q3	2N2708	IF Amplifier
Q4	2N706	21.4-mc Amplifier
Q5	2N2708	IF Amplifier
Q6	2N2708	IF Amplifier
Q7	2N2708	IF Amplifier
Q8	2N2708	AM Detector
Q9	2N706	Symmetrical Limiter
Q10	2N706	Symmetrical Limiter
Q11	2N706	Symmetrical Limiter
Q12	2N706	Symmetrical Limiter
Q13	2N706	Symmetrical Limiter
Q14	2N706	Symmetrical Limiter
Q15	2N706	Summing Amplifier
Q16	2N706	Summing Amplifier
	Video Amplifier	
A1-A2Q1	2N3251	DC Amplifier
A1-A2Q2	2N706	DC Amplifier
A1-A2Q3	2N3251	Emitter Follower
A1-A2Q4	2N706	Emitter Follower
	Video Amplifier	
A3Q1	2N706	Emitter Follower
A3Q2	2N3251	Emitter Follower
	AGC Amplifier	
A4Q1	2N697	DC Amplifier
A4Q2	2N697	AGC Regulator

Figure 2-1

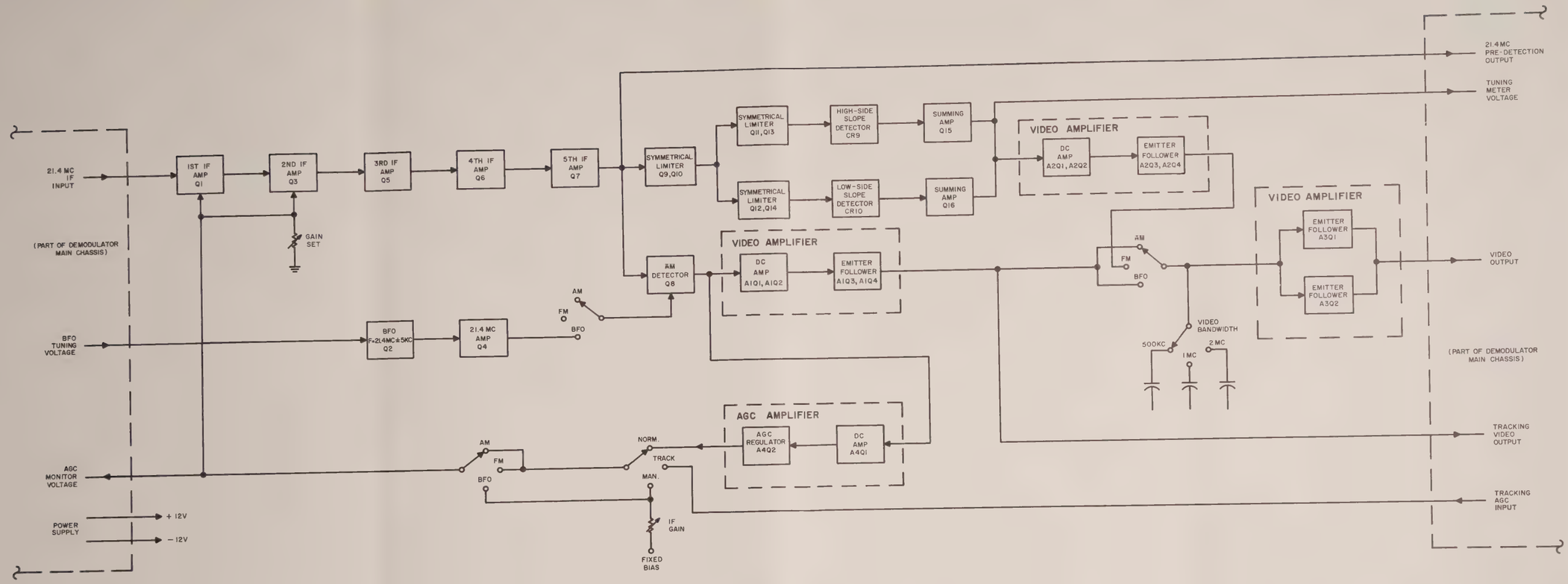


Figure 2-1. Type IFD-4000B IF Demodulator, Functional Block Diagram

SECTION II

CIRCUIT DESCRIPTION

2.1 GENERAL

A circuit description of the type IFD-4000B IF Demodulator is given in the following paragraphs using the block diagram, Figure 2-1, and the over-all schematic diagram, Figure 6-1. Note that the unit numbering system is used for the electrical components, which means that parts in subassemblies carry a prefix before the usual class letter and number of the item (such as A1C1 and A1Q2). These prefixes are omitted on illustrations and in the text except in those cases where confusion might result from their omission.

2.2 FUNCTIONAL ANALYSIS

The type IFD-4000B Demodulator is one of several plug-in units which are used in conjunction with the demodulator main chassis. All of these plug-in modules receive operating voltages and establish signal inputs and outputs through a connector located on the rear apron.

2.2.1 The 21.4-mc IF input signal enters the unit from the demodulator main chassis and is applied to the first IF amplifier stage Q1. The 21.4-mc output from Q1 is applied to four more IF amplifier stages: Q3, Q5, Q6, and Q7. The interstage networks located between the IF amplifiers establish the bandwidth of the IF strip at 4 mc. Stagger tuning is used to obtain the necessary bandwidth. Transistor Q7 is tuned to the 21.4-mc center frequency, Q1 and Q5 are tuned to the low side of the center frequency, and Q3 and Q6 are tuned to the high side.

2.2.2 The 21.4-mc IF output from the fifth IF amplifier, Q7, is simultaneously applied to the AM detector, the FM limiters, and to the 21.4-mc pre-detection output. The signal path to the FM detector contains three symmetrical limiter stages (Q9-Q10, Q11-Q13, and Q12-Q14) which remove amplitude variations from the signal. The output of the second pair of symmetrical limiters is demodulated by two slope detectors which contain diodes CR9 and CR10. The outputs from the slope detectors are combined in two summing amplifier stages, Q15 and Q16. The FM video signal is then applied to one of the three video amplifiers contained within the IFD-4000B and to the tuning meter output. This particular video amplifier, A2, contains two voltage amplifier stages, A2Q1 and A2Q2, driving emitter followers A2Q3 and A2Q4 which are connected in a complementary symmetry configuration. The FM video output from the amplifier is connected to the FM position of the mode selector switch.

2.2.3 The AM video signal output from the infinite-impedance type AM detector (Q8) is applied to a second video amplifier assembly, A1, and also the the input of the AGC amplifier. This video amplifier is identical to A2. The output of A1 is simultaneously connected to the AM and BFO positions on the mode selector switch and to the tracking video output. In certain operating modes, the demodulator main chassis (in conjunction with other plug-in modules) converts this tracking video signal to a dc voltage which re-enters the IFD-4000B as the tracking AGC input.

2.2.4 In the AGC amplifier assembly, the AM detector output is applied to a dc amplifier stage, A4Q1. The voltage output of A4Q1 is used to control conduction through the regulator stage, A4Q2. If the AGC selector switch is in the NORM position and the mode selector switch is in either the AM or FM positions, then the output of stage A4Q2 is used to control the gain of the first and second IF amplifiers, Q1 and Q3.

2.2.5 Three gain control modes are possible during AM or FM reception: normal (NORM), tracking (TRACK), and manual (MAN). In all three modes the gain control voltage is applied to the base circuits of Q1 and Q3. An additional control over the gain in all modes is provided by the GAIN SET control which varies the resistance in the emitter circuits of Q1 and Q3. In the normal mode, the AGC voltage is derived from the AM detector output through the AGC amplifier. In the tracking mode, the gain control voltage is provided by the demodulator main chassis and enters the IFD-4000B as the tracking AGC input. In the manual mode, the gain of the IFD-4000B is controlled by a voltage derived from the IF GAIN potentiometer. During CW reception (BFO position) only manual gain control is possible. The gain control voltage which is applied to stages Q1 and Q3 is also connected into the demodulator main chassis as the signal strength voltage.

2.2.6 The BFO (beat frequency oscillator) is activated when the mode selector switch is placed in the BFO position. The 21.4 mc output of the BFO stage, Q2, is amplified by stage Q4 and applied to the AM detector. The pitch of the CW audio signal is varied by means of a control located on the demodualtor main chassis. This control furnishes a variable dc voltage to the IFD-4000B (BFO tuning voltage) which can shift the frequency of the BFO stage ±5 kc from the normal 21.4-mc output.

2.2.7 The FM video signal appears at the FM position of one of the mode selector switch sections. The AM video signal appears at the AM and BFO positions. Depending on the switch setting, either the AM or FM video signal is connected from the arm of this switch section to the input of the third video amplifier, A3. This amplifier contains a NPN transistor, A3Q1, and a PNP transistor, A3Q2, connected in a complementary symmetry configuration. The video output from this amplifier is connected into the demodulator main chassis. The video bandwidth switch, connected at the input of the video amplifier sets the bandwidth of the video output at either 500 kc, 1 mc, or 2 mc.

2.3 IF AMPLIFIERS

The IF input signal is terminated in a 51-ohm load, R1, with C3 providing coupling to the base of Q1, the first of five IF amplifier stages. Each stage is single-tuned by a variable inductor in its collector circuit. Stagger tuning is used to obtain the required 4-mc bandwidth. Inductor L8 resonates with its distributed capacity at 21.4 mc; L2 and L6 are tuned below the center frequency, and L4 and L7 are tuned above it. Each inductor is shunted by a resistor to lower its Q, and thus increase the bandwidth. A 47-ohm resistor is included in each collector lead to suppress parasitic oscillations. AGC control of Q1 and Q2 is accomplished by decreasing the positive bias with increasing signal strength. In addition, the GAIN SET control, R33, sets the gain of the two stages by varying the resistance in the emitter circuits of Q1 and Q3. Resistors R48 and R61 apply a constant voltage to the base of the two transistors to increase the AGC range. The output of the fifth IF amplifier, Q7, is applied simultaneously to the AM detector, the FM limiters, and to the 21.4-mc pre-detection output.

2.4 AM DETECTOR

The AM detection is performed in the base-emitter junction of stage Q8, an infinite-impedance type detector. This NPN-type transistor conducts on the positive excursions of the input signal. When Q8 conducts, the current which flows from the collector to the emitter represents the modulating frequency. Capacitor C43 is used in conjunction with C65, R52 and R90 to provide the proper time constant for the detector output. Any remaining RF carrier is suppressed by L15. Test point TP1 is provided for monitoring the output of the AM detector. The output of the AM detector is coupled into the video amplifier A1, and the AGC amplifier A4.

2.5 LIMITER STAGES

The 21.4-mc signal from the IF amplifiers is fed to a symmetrical limiter stage formed by Q9 and Q10 from a capacitive voltage divider. The incoming signal swings about a dc level of approximately +3 volts established by base-bias resistors R54 and R55. Similar networks are in the base circuits of the other limiter stages. Transistors Q9 and Q10 share a common emitter resistor, R56. Under no-signal conditions the combined emitter currents of the two transistors develop a voltage across R56 which approaches +3 volts. When a signal is applied to the base of Q9, the positive-going half cycle causes increased conduction through Q9 which increases the voltage drop across R56. If the input signal has sufficient amplitude the voltage drop across R56 will reverse bias the base-emitter junction of Q10, cutting the transistor off. On the negative-going half cycle, the decreased drop across R56 will cause Q10 to conduct to saturation. Thus the transistor operates between cut off and saturated conditions, limiting both the positive and negative cycles of the input signal. The base of Q10 is held at RF ground potential by capacitor C45. Diodes CR3, CR4 and CR5 in the base circuit of Q9 prevent large positive-going signals from over-loading the limiter, and large negative-going signals from back biasing the base-emitter junction of Q9. If the input signal exceeds approximately 6.6 volts peak-to-peak, Zener diode CR4 breaks down and clips positive-going excursions in excess of approximately 3.4 volts. Negative-going excursions in excess of approximately 3.2 volts forward bias CR5, shorting to ground signal voltage greater than the negative clipping level. Diode CR3 in series with CR4 blocks the Zener on negative excursions, preventing it from acting as an ordinary diode. The first limiter output is coupled in parallel to the second and third limiters through capacitor C48. Operation of these limiters is identical to that of the first.

2.6 FM DETECTOR

The outputs from the limiter stages formed by transistors Q11-Q13 and Q12-Q14 are used to drive two slope detectors. These outputs are coupled into the slope detectors by capacitors C55 and C57. The detector circuit which includes diode CR9 is resonant on the high side of the 21.4-mc IF while the other circuit (which includes diode CR10) is tuned on the low side of the IF. Since the two diodes are connected in opposite directions, the outputs from the two detector circuits will be of opposite polarity. And since the detectors are tuned to different frequencies, the peaks of the opposite-polarity responses are separated by approximately 4 mc. The summing amplifiers, Q15 and Q16, combine the outputs of the slope detectors to produce a conventional discriminator S-curve response.

2.7 VIDEO AMPLIFIERS (A1 and A2)

The amplifiers consist of cascaded voltage amplifiers, Q1 and Q2, driving emitter followers Q3 and Q4 which are connected in a complementary symmetry configuration. The latter two transistors operate essentially as a push-pull class B amplifier. Silicon diodes CR2 and CR3 serve a dual function. First, they set the proper dc bias level at the bases of Q3 and Q4. Secondly, they provide stabilization with temperature changes. The transistors and diodes are made of the same material, and therefore exhibit the same temperature coefficient of resistance characteristics. A rise in temperature lowers the base-emitter resistance of the transistors, tending to make them conduct harder. However, the diode resistance decreases by the same amount so that the base voltage drops, decreasing the forward bias on the transistors, and thus holding the collector current nearly stable. Resistors R7 and R8 in the emitters of Q3 and Q4 are included primarily to prevent thermal runaway, but also serve to compensate for temperature variations. Negative feedback to extend the frequency response of the amplifier is taken at the junction of R9 and R10 and fed back to the emitter of Q1 through CR1. Diode CR1 cancels out the voltage drop across the base-emitter junction of Q1, preventing the voltage from appearing at the output of the amplifier.

2.8 VIDEO AMPLIFIER (A3)

This amplifier consists of emitter followers Q1 and Q2 connected in a complementary symmetry configuration. It contains compensating diodes which function as described in paragraph 2.7. This amplifier receives its input from A1 or A2, depending on the position of the mode selector switch, and provides the video output from the module to the demodulator main chassis.

2.9 AGC AMPLIFIER

The AGC amplifier receives its input from the output of the AM detector, Q8. Two modulation filters, one at the input (A4C1 and A4R1) and one at the output (C32 and R41) of the dc amplifier, A4Q1, permit this stage to amplify only the average changes in carrier level. AGC regulator A4Q2 is connected between the +12-volt supply and the base bias circuits of Q1 and Q3. The conduction of A4Q2, and thus the bias voltage for Q1 and Q3, is controlled by A4Q1. As the input signal increases above the AGC threshold, A4Q1 conducts harder, reducing the conduction through A4Q2. This results in a decreased froward bias on Q1 and Q3 so that the gain of these stages is reduced.

2.10 MODE SELECTOR SWITCH

The MODE SEL switch, S1, is a three-position, three-section wafer switch which is used to select the mode of operation: AM, FM or BFO. When section S1D of this switch is in the AM or BFO positions, the signal from the output of video amplifier A1 is coupled to the VIDEO BANDWIDTH switch. When this switch is in the FM position, the output of amplifier A2 is coupled to the VIDEO BANDWIDTH switch. Section S1B is used to activate the beat frequency oscillator. When placed in the BFO position, this section applies +12 vdc to the collector circuits of Q2 and Q4. While this switch is in the AM or FM position, a slightly negative voltage is maintained at the collectors of Q2 and Q4 by forward biasing diode CR2 through R34. The third section, S1A, operates in conjunction with the AGC selector switch in establishing the AGC operating modes.

2.11 AGC SELECTOR SWITCH

The AGC SEL is a three-position switch permitting front-panel control of the type of gain control used for the first and second IF amplifiers. When this switch is in the NORM position, the AGC amplifier output

is used to supply the internally-derived AGC voltage to the first and second IF amplifiers. In the TRACK position, a tracking AGC voltage is supplied from the demodulator main chassis and used to control the gain of the first and second IF amplifiers. When this switch is in the manual position, the IF GAIN control is used to vary the gain of the first and second IF amplifiers.

2.12 VIDEO BANDWIDTH SWITCH

The VIDEO BANDWIDTH switch is connected in the input circuit of video amplifier A3. This switch is used to set the video output bandwidth at 500 kc, 1 mc, or 2 mc. The bandwidths are determined by the value of the capacitor used in the respective positions.

2.13 BEAT FREQUENCY OSCILLATOR

The BFO is used to produce an audio beat note when receiving CW signals. It operates only when the MODE SEL switch is in the BFO position. This applies +12 volts to Q2 and Q4. Transistor Q2 operates as a Colpitts oscillator and frequency doubler. The base circuit resonates at approximately 10.7 mc and the collector circuit is tuned to 21.4 mc. The 21.4-mc BFO signal is applied to the emitter of a buffer-amplifier, Q4. From the single-tuned collector circuit of Q4, the signal is coupled through C23 to the AM detector. The pitch of the beat note produced can be varied by the BFO tuning control on the DM-4B front panel. This control varies the dc voltage across the voltage-variable capacitor CR1. A voltage-variable capacitor is a solid-state device whose capacitance varies as a function of the voltage across its terminals. Since CR1 and series capacitor C10 provide a capacitance which shunts the tuned circuit in the base of Q2, changing the capacitance of CR1 changes the oscillator frequency. Positioning the MODE SEL switch to any other setting applies -12 volts to the BFO. This turns off the BFO and forward biases CR2. The low impedance of CR2 in the conducting state prevents the tuned circuit (C21 and L5) from affecting the response of the last IF amplifier stage.

2.14 ADDITIONAL OUTPUTS

The signal strength voltage output is taken from the arm of switch section S1A. The tuning meter output is obtained from the output of the summing amplifiers. The AGC track output is obtained from the output of the video amplifier A1.

SECTION III

INSTALLATION AND OPERATION

3.1 INSTALLATION

The type IFD-4000B IF Demodulator is designed to operate in conjunction with the DM-4B Demodulator. This module will operate in any of the four DM-4B module positions. Approximate space requirements are 4.5 inches high, 2.25 inches wide, and 13.5 inches projection into the DM-4B. Adequate ventilation should be provided for proper operation of the module and also to prevent unnecessary aging of components.

3.1.1 Inserting Module. - Place the module in any one of four positions in the DM-4B. The guide pins on the rear apron of the module will properly seat the receptacle on the rear of the module with the receptacle at the rear of the slot of the DM-4B into which the module is being placed.

3.1.2 Inputs/Outputs. - All signal inputs and outputs of the module are accomplished through the 15-pin connector on the rear apron of the module.

3.1.3 Operating Voltages. - The necessary operating voltages for the module are supplied by the DM-4B. The power/on-off switch is located on the DM-4B front panel.

3.2 OPERATION

The operating controls on the front panel of the module are described in the following paragraphs. These controls are shown in Figure 1-1.

3.2.1 AGC Selector. - The AGC SEL switch determines the type of gain used for the module: NORM, TRACK, or MAN. The normal AGC is provided by circuitry within the module. The tracking AGC is supplied from the demodulator main chassis. The manual type of gain control is supplied by the IF GAIN potentiometer.

3.2.2 Mode Selector. - Set the MODE SEL switch to the AM, FM or BFO (For CW reception) positions as desired before tuning. In the BFO position, the gain must be manually adjusted using the IF GAIN control.

3.2.3 Video Bandwidth. - The VIDEO BANDWIDTH switch allows the operator to select one of three video output bandwidths as marked on the panel.

3.2.4 Gain Set. - The GAIN SET potentiometer varies the gain of the first and second IF amplifiers by ±6 db.

3.2.5 IF Gain. - This control varies the amount of gain control voltage applied to the first and second IF amplifiers when the AGC SEL switch is in the MAN position and the MODE SEL switch is in the AM, FM or BFO position.

SECTION IV

MAINTENANCE

4.1 GENERAL

The type IFD-4000B IF Demodulator has been carefully designed so that it will operate for long periods of time with little more than routine maintenance. Should trouble occur, it is important that maintenance personnel be familiar with Section II, in which the circuits are described. In addition, they should refer to Figures 5-1 through Figure 5-9 where the component locations are shown; to the schematic diagram, Figure 6-1; and to Table 4-1, the transistor pin socket voltages.

CAUTION

All maintenance work within this unit should be kept to a minimum and performed only by trained and experienced personnel. The placement of components and the dress of leads in the equipment have been carefully engineered to give optimum performance. In replacing any components, great care should be exercised to duplicate the exact physical layout of the original assembly.

4.2 TROUBLESHOOTING

Most troubles will be caused by failures of the transistors or diodes. The proper functioning of all these parts should be assured by either test or by replacement with parts known to be good before any further troubleshooting is carried out. After the above measure has been carried out, initial troubleshooting should be directed toward localizing the problem to a specific portion of the unit. One procedure which should be considered for localizing troubles is to feed in a signal at the input and then check the signals present at each test point. To this end, it is desirable that all maintenance personnel familiarize themselves with the alignment procedures, even if an alignment is not required, as those procedures include methods of checking performance which may help in analyzing the cause of the trouble. In addition, be certain that the DM-4B power supply is functioning normally before any other circuit is suspected. Table 4-2 contains guides which may be useful in troubleshooting.

4.3 .ALIGNMENT INSTRUCTIONS

The alignment procedures in this book are suitable for performance in the field when making periodic performance checks, or when making adjustments after replacing components. Only those controls specifically referred to within a series of steps given for aligning a particular circuit affect the operation of that circuit. Those controls not mentioned in any one series of steps may be left in any position. The alignment of this unit should be performed only with suitable equipments by technicians thoroughly familiar with their use. If the limits and tolerances specified in the following steps cannot be obtained during a field alignment, a factory alignment is necessary. Allow several minutes for warm-up before beginning the work.

4.3.1 Use of Marker During Alignment. - A post-detection type of marker adder is recommended, and the alignment procedures in this book assume that one is used. However, if such a marker adder is not available, the marker generator output should be loosely coupled to the sweep generator output. This can be done by connecting the marker signal source to a turn or two of insulated wire wrapped around the sweep generator lead near the point of connection to the circuit under test, or by coupling to the sweep generator lead through a small capacitor. To insure that the addition of the marker is not affecting the response curve, disconnect the marker generator and observe that no change in the curve's shape or symmetry occurs.

4.3.2 Use of Oscilloscope During Alignment. - The vertical and horizontal amplifier inputs on the oscilloscope should be set in the dc coupled mode. The dc component of the signal on the vertical input should be cancelled out by applying an equal voltage to the unused vertical differential scope input, since the dc component sometimes makes

it impossible to center the signal vertically. Otherwise it will sometimes be necessary to use the ac-coupled mode. A low-capacity shielded cable should be used to connect to the oscilloscope, and the shield should be grounded as closely as possible to the point to which the center conductor is connected. The oscilloscope horizontal amplitude control should be set to obtain a 10-cm wide sweep during all the alignment steps.

4.3.3 Equipments Required. - The following equipments, or their equivalents, are required to perform the complete IFD-4000B alignment.

(1) Sweep Generator, Telonic Type SM-2000
(2) Sweep Generator Plug-in, Telonic Type LH-2
(3) Sweep Generator Internal Marker, Telonic Type C (with 21.400-mc CR-18/U crystal)
(4) Oscilloscope, Tektronix Type 503
(5) Signal Generator, Hewlett Packard Type 606A
(6) Frequency Counter, Computer Measurements Corp. Type 738A
(7) Demodulator, Communication Electronics Type DM-4B
(8) Test Cable, Communication Electronics Type EC-101B or one fabricated using one Cannon DBM-17W-2P connector (with two DM53740-5001 inserts), and one Cannon DBM-17W-2S connector (with two DM53742-5001 inserts).
(9) Assorted cables, connectors and alignment tools.

4.4 ALIGNMENT PROCEDURE

The complete alignment procedure for the IFD-4000B is given in the following paragraphs.

4.4.1 Initial Settings and Calibration.

(1) On IFD-4000B place MODE SEL in AM position, AGC SEL in MAN position, VIDEO BANDWIDTH in 2 MC position, rotate GAIN SET control to maximum clockwise position.
(2) Using the frequency counter, calibrate the HP606A signal generator for an output of 21.400 ±.002 mc.
(3) Set signal generator output level at 0.1v.
(4) Connect equipment as shown in Figure 4-1.
(5) Adjust IF GAIN control on IFD-4000B for 0.6 vdc output at TP1 as indicated by oscilloscope.

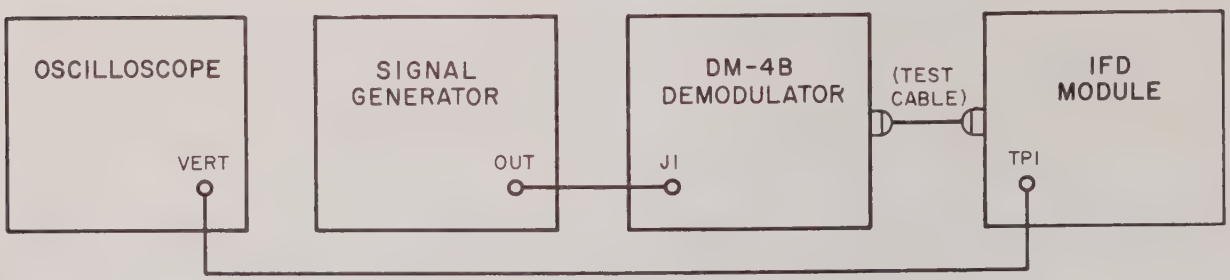


Figure 4-1. Equipment Setup, Calibration and BFO Alignment

4.4.2 IF Alignment. - Proceed as follows:

(1) Connect equipment as shown in Figure 4-2.
(2) Set sweep generator for 21.4-mc center frequency output. Turn the internal 21.4-mc marker on.

(3) Adjust sweep generator and oscilloscope controls until a response curve is displayed.

(4) Adjust the sweep generator output attenuator for a 0.8 volt peak-to-peak response curve. Any further adjustments to maintain to 0.8 volt peak-to-peak response as the alignment proceeds must be done by adjusting the IF GAIN control on the IFD-4000B.

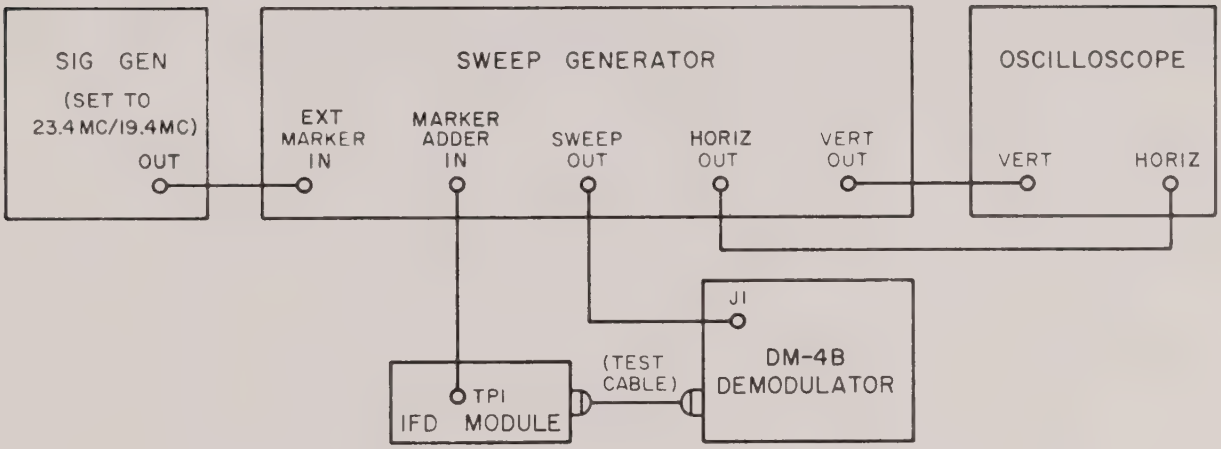


Figure 4-2. Equipment Setup, IF Alignment

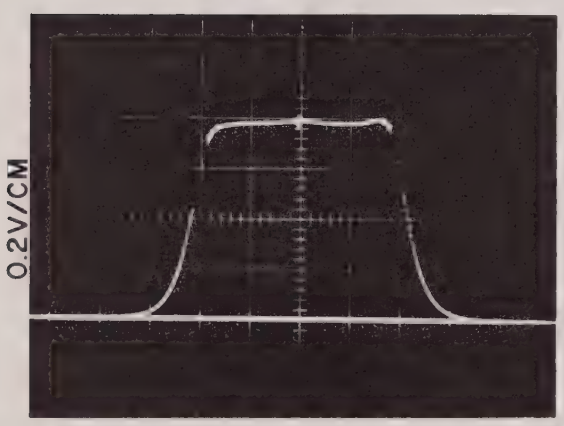


Figure 4-3. Typical Response Curve, IF Alignment

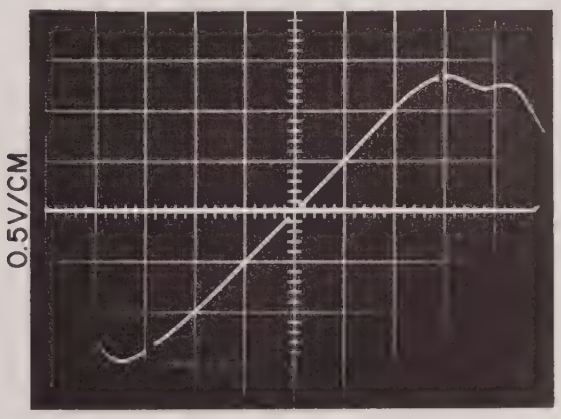


Figure 4-4. Typical Response Curve, Discriminator Alignment

(5) Adjust L2, L4, L6, L7 and L8 for a response curve centered about the 21.4-mc marker similar to Figure 4-3. Use the signal generator as a marker to check for 3-db response at 19.4-mc and 23.4-mc. Note that this IF is stagger tuned. L8 affects the center of the response curve, L2 and L6 the low frequency side, and L4 and L7 the high frequency side.

4.4.3 Discriminator Alignment. - Proceed as follows:

(1) Equipment setup remains the same as Figure 4-2, except that the sweep generator marker adder input is now connected to TP4, FM DET.

(2) Adjust the sweep generator and oscilloscope to display an "S" response curve.
(3) Adjust L12 and L13 for zero crossing at the 21.4-mc marker, and for maximum linearity between 19.4 mc and 23.4 mc. Use the signal generator as a marker to determine the linearity limits. A typical response is shown in Figure 4-4.

4.4.4 BFO Alignment. - Proceed as follows:

(1) Calibrate the signal generator for a 21.400 ±.002 mc output using the frequency counter. Set output level for 0.1v.
(2) Connect equipment as shown in Figure 4-1.
(3) Set the IFD-4000B mode selector to BFO and the BFO TUNING control on the DM-4B to midrange.
(4) Adjust L3 and L5 for maximum dc voltage at TP1.
(5) Remove the bottom cover of the IFD-4000B and adjust L1 for a zero-beat indication on the oscilloscope.

Table 4-1. Transistor Socket Pin Voltages

Ref. Desig.	Type	Transistor Element		
		Emitter	Base	Collector
Q1	2N2708	0.07	0.72	10.2
Q2	2N706	2.6	2.7	8.2
Q3	2N2708	0.0	0.6	10.2
Q4	2N706	1.8	2.2	9.6
Q5	2N2708	1.0	1.7	10.2
Q6	2N2708	1.4	2.2	10.2
Q7	2N2708	2.2	2.9	11.2
Q8	2N2708	0.0	0.6	11.5
Q9	2N706	2.5	3.2	11.5
Q10	2N706	2.5	3.2	11.5
Q11	2N706	2.5	3.2	11.5
Q12	2N706	2.6	3.2	11.5
Q13	2N706	2.5	3.2	11.5
Q14	2N706	2.6	3.3	11.5
Q15	2N706	1.2	1.8	11.5
Q16	2N706	-0.3	0.3	11.5
A1-A2Q1	2N3251	1.2	-10.8	-10.8
A1-A2Q2	2N706	-11.5	0.32	0.32
A1-A2Q3	2N3251	1.0	1.7	-11.5
A1-A2Q4	2N706	1.0	0.5	11.5
A3Q1	2N706	0.0	0.6	11.5
A3Q2	2N3251	0.0	-0.7	-11.5
A4Q1	2N697	0.1	0.0	10.8
A4Q2	2N697	10.2	10.8	11.5

Test Conditions: All voltages are positive dc with respect to chassis unless otherwise noted. The DM-4B was used as the power source; 120 vac was applied to the DM-4B. Readings taken with an RCA WV-98B VTVM. Control settings as follows: MODE SEL in AM; AGC SEL in NORM; GAIN SET at max cw; IF GAIN at max cw; VIDEO BANDWIDTH at 2 MC. No input signal applied.

Notes: *MODE SEL in BFO.

Table 4-2. Type IFD-4000B IF Demodulator, Troubleshooting Chart

SYMPTOM	PROBABLE CAUSE	REMEDY
No input signal on base of Q1.	a. Shorted resistor. b. Open capacitor.	a. Check R1 for short. b. Check C3 for open and replace if necessary.
No AGC to base of Q1.	a. Open resistive divider network.	a. Check R3, R4, and R5 for open and replace as necessary.
Q1 oscillates.	a. Open resistor or open capacitor in the shelf network.	a. Check R9 and C9 for open and replace as necessary.
No output from Q1	a. Defective transistor.	a. Replace Q1.
Parasitic oscillations in Q1	a. Resistor shorted.	a. Replace R7.
No output from Q3, Q5, Q6, or Q7	a. Defective transistor(s)	a. Check output of each transistor with oscilloscope until the defective transistor is located. Replace defective transistor.
No output from AM detector.	a. Defective transistor.	a. Replace Q8.
RF reaching base of video amplifier, A1Q1.	a. Defective filter component.	a. Check C43, C65, L15, and R52.
No signal to base of Q9.	a. Shorted diodes.	a. Check CR3, CR4, and CR5 for short and replace if necessary.
No output from Q10.	a. Defective transistor.	a. Check Q9 and Q10 and replace as necessary.
No output from Q13.	a. Defective transistor.	a. Check Q11 and Q13 and replace as necessary.
No output from Q14.	a. Defective transistor.	a. Check Q12 and Q14 and replace as necessary.
FM output distorted.	a. Defective diode.	a. Check CR9 and CR10 and replace if defective.
No output observed at TP4	a. Defective transistor. b. Open resistor.	a. Check Q15 and Q16 and replace as necessary. b. Check R84, R85, R86, and R87. Replace as necessary.

Table 4-2. Type IFD-4000B IF Demodulator, Troubleshooting Chart - (Cont'd.)

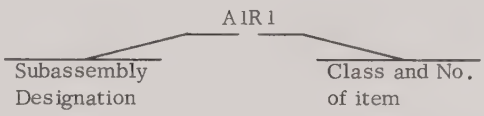
SYMPTOM	PROBABLE CAUSE	REMEDY
No tuning meter output.	a. Open resistor.	a. Check R88 and replace if necessary.
Input to A1 video amplifier present but no output.	a. Video amplifier defective.	a. Replace or repair module.
No input to A3 amplifier.	a. Defective switch. b. Shorted capacitor.	a. Check S1D and S3. b. Check C58, C59, and C69.
No output from video amplifier, A3.	a. Defective module.	a. Repair or replace A3 video amplifier.
No input to base of A4Q1.	a. Open resistor. b. Shorted capacitor.	a. Check A4R1 for open and replace. b. Check A4C1 for short and replace if necessary.
No output from A4Q1.	a. Defective transistor.	a. Replace A4Q1.
No output from A4Q2.	a. Defective transistor.	a. Replace A4Q2.
Oscillator section of Q2 is not tunable.	a. Defective tuning coil. b. Loss of BFO tuning voltage.	a. Check L1 for open or short and replace if necessary. b. Check CR1 for short, and check input to CR1 for open.
No output from Q2.	a. Defective transistor.	a. Replace Q2.
No output from Q4.	a. Defective transistor. b. Open capacitor. c. Shorted diode.	a. Replace Q4. b. Check C23. Replace if necessary. c. Check CR2 for short and replace if necessary.

SECTION V

REPLACEMENT PARTS LIST

5.1 UNIT NUMBERING METHOD

The unit numbering method of assigning reference designations (electrical symbol numbers) has been used to identify assemblies, subassemblies (and modules), and parts. An example of the unit method follows:



Read from right to left as: First (1) resistor (R) of first (1) subassembly (A)

As shown on the main chassis schematic, components which are an integral part of the main chassis have no subassembly designation.

5.2 REFERENCE DESIGNATION PREFIX

Partial reference designations have been used on the equipment and on the illustrations in this manual. The partial reference designations consist of the class letter(s) and identifying item number. The complete reference designations may be obtained by placing the proper prefix before the partial reference designations. Prefixes are provided on drawings and illustrations following the notation "REF DESIG PREFIX."

5.3 LIST OF MANUFACTURERS

Vendor Code	Name and Address	Vendor Code	Name and Address
01121	Allen-Bradley Company 136 West Greenfield Avenue Milwaukee, Wisconsin	56289	Sprague Electric Company 91 Marshall Street North Adams, Massachusetts
01281	Pacific Semiconductors, Inc. 10451 West Jefferson Boulevard Culver City, California	71450	Chicago Telephone Supply Corporation 1142 West Beardsley Avenue Elkhart, Indiana
02114	Ferroxcube Corporation of America Saugerties New York	71468	Cannon Electric Company 3208 Humbolt Street Los Angeles, California
04013	Taurus Corporation 8 Coryell Street Lambertville, New Jersey	72982	Erie Technological Products, Inc. 644 West 12th Street Erie, Pennsylvania
07688	Joint Electron Device Engineering Council Washington, D. C.	74868	Amphenol RF Division 33 East Franklin Street Danbury, Connecticut
14632	Communication Electronics, Inc. 6006 Executive Boulevard Rockville, Maryland	81716	Oak Manufacturing Company Crystal Lake Illinois
37942	P. R. Mallory and Company 80 South Gray Street Indianapolis, Indiana	84171	Arco Electronics, Inc. Community Drive Great Neck, New York

Vendor Code	Name and Address	Vendor Code	Name and Address
91418	Radio Materials Corporation 4242 West Bryn Mawr Avenue Chicago, Illinois	99848	Wilco Corporation 546 Drover Street Indianapolis, Indiana

5.4 PARTS LIST

When ordering replacement parts from CEI, specify the type and serial number of the equipment, and the reference designation and description of each part ordered. The Vendors and Vendor Part Numbers listed are included as a guide to the user of the equipment in the field and do not necessarily agree with the parts installed in the equipment. Except in those cases specifically noted, the replacement pary may be obtained from any vendor as long as the physical and electrical parameters of the part selected agree with the original part.

NOTE

As improved semiconductors become available it is the policy of CEI to incorporate them in proprietary products. For this reason some transistors and diodes installed in an equipment may not agree with those specified in the parts lists and schematic diagrams of this manual. However, the semiconductors designated in the manual may be substituted in every case with satisfactory results.

5.4.1 Main Chassis

Ref. Desig.	Description	Vendor Part No.	Vendor Code
A1	VIDEO AMPLIFIER	10967-1	14632
A2	Same as A1		
A3	VIDEO AMPLIFIER	10951-1	14632
A4	AGC AMPLIFIER	11019	14632
C1	CAPACITOR, CERAMIC FEEDTHRU: 1000 pf, GMV	FA5C-102W	01121
C2	Same as C1		
C3	CAPACITOR, CERAMIC DISC: 1000 pf, GMV	SM	91418
C4	CAPACITOR, CERAMIC TUBULAR: 10 pf, ±.5 pf (TC Type N750)	301-000-U2J0-100D	72982
C5	CAPACITOR, DIPPED MICA: 43 pf, 5%	DM10-430J	84171
C6	Same as C3		
C7	CAPACITOR, DIPPED MICA: 180 pf, 5%	DM10-181J	84171
C8	CAPACITOR, DIPPED MICA: 160 pf, 5%	DM10-161J	84171
C9	CAPACITOR, CERAMIC DISC: .005 μf, 20%	SM	91418
C10	CAPACITOR, DIPPED MICA: 47 pf, 5%	DM10-470J	84171
C11	CAPACITOR, DIPPED MICA: 39 pf, 5%	DM10-390J	84171
C12	CAPACITOR, DIPPED MICA: 620 pf, 5%	DM15-621J	84171
C13	CAPACITOR, DIPPED MICA: 100 pf, 5%	DM10-101J	84171
C14	CAPACITOR, CERAMIC DISC: .01 μf, 20%, 200V	4835-000-Z5U0-103M	72982
C15	CAPACITOR, DIPPED MICA: 910 pf, 5%	DM15-911J	84171
C16	Same as C9		
C17	Same as C14		
C18	Same as C3		
C19	Same as C10		
C20	CAPACITOR, DIPPED MICA: 560 pf, 5%	DM15-561J	84171
C21	CAPACITOR, DIPPED MICA: 51 pf, 5%	DM10-510J	84171
C22	Same as C14		
C23	CAPACITOR, CERAMIC TUBULAR: 2.2 pf, ±.25 pf	301-000-COJO-229C	72982
C24	Same as C9		
C25	Same as C14		
C26	CAPACITOR, DIPPED MICA: 33 pf, 5%	DM10-330J	84171
C27	Same as C7		
C28	Same as C14		
C29	Same as C9		
C30	Same as C10		

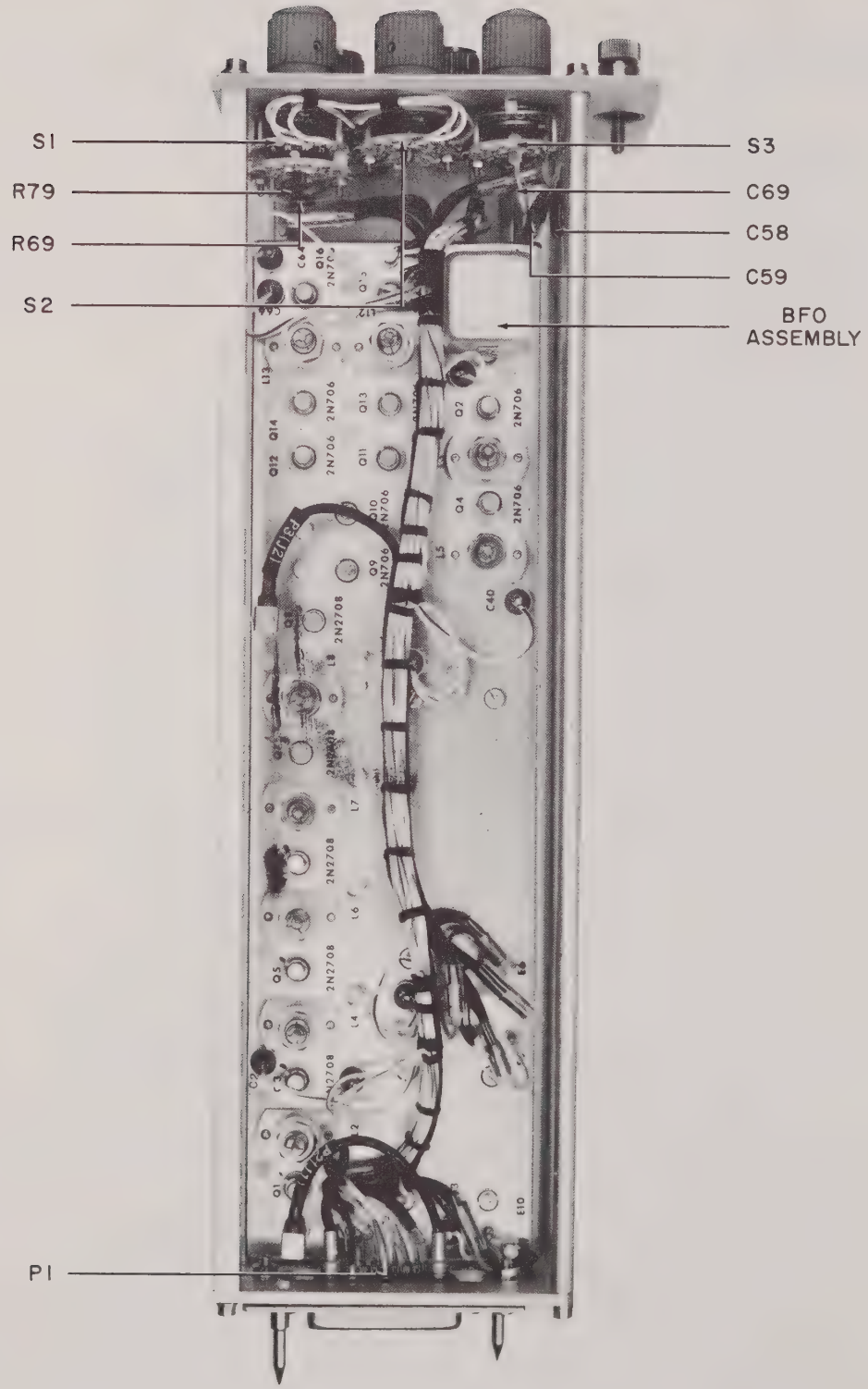


Figure 5-1. Type IFD-4000B IF Demodulator, Left-Side View

Ref. Desig.	Description	Vendor Part No.	Vendor Code
C31	Same as C20		
C32	CAPACITOR, ELECTROLYTIC: 1.5 μf, 20%, 35V	150D155X0035B2	56289
C33	Same as C14		
C34	Same as C1		
C35	Same as C9		
C36	CAPACITOR, DIPPED MICA: 24 pf, 5%	DM10-240J	84171
C37	CAPACITOR, DIPPED MICA: 62 pf, 5%	DM10-620J	84171
C38	CAPACITOR, DIPPED MICA: 240 pf, 5%	DM15-241J	84171
C39	Same as C3		
C40	Same as C1		
C41	Same as C1		
C42	Same as C14		
C43	CAPACITOR, DIPPED MICA: 18 pf, 5%	DM10-180J	84171
C44	Same as C14		
C45	Same as C3		
C46	Same as C1		
C47	CAPACITOR, ELECTROLYTIC: 1 μf, 10%, 35V	150D105X9035A2	56289
C48	Same as C3		
C49	Same as C1		
C50	Same as C14		
C51	Same as C3		
C52	Same as C14		
C53	Same as C3		
C54	Same as C14		
C55	Same as C3		
C56	Same as C14		
C57	Same as C3		
C58	CAPACITOR, DIPPED MICA: 2200 pf, 5%	DM19-222J	84171
C59	CAPACITOR, DIPPED MICA: 1100 pf, 5%	DM19-112J	84171
C60	CAPACITOR, DIPPED MICA: 12 pf, 5%	DM10-120J	84171
C61	CAPACITOR, DIPPED MICA: 20 pf, 5%	DM10-200J	84171
C62	Same as C4		
C63	Same as C4		
C64	Same as C1		
C65	CAPACITOR, DIPPED MICA: 22 pf, 5%	DM10-220J	84171
C66	Same as C1		
C67	Same as C1		

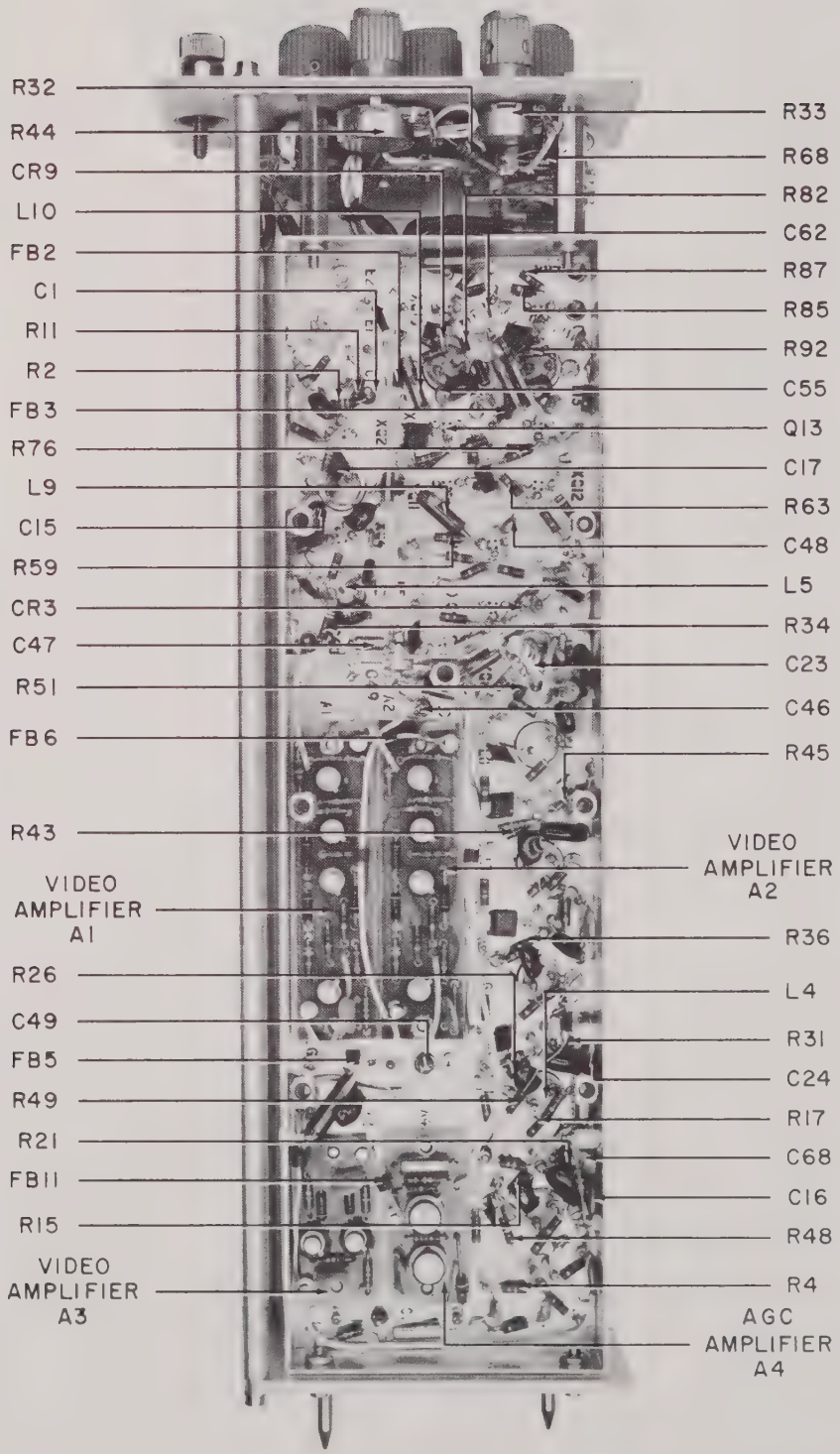


Figure 5-2. Type IFD-4000B IF Demodulator, Right-Side View

Ref. Desig.	Description	Vendor Part No.	Vendor Code
C68	CAPACITOR, CERAMIC DISC: 470 pf, 20%, 1000V	B	91418
C69	Same as C68		
C70	CAPACITOR, ELECTROLYTIC, TANTALUM: 47 μf, 10%, 6V	150D476X9006B2	56289
C71	CAPACITOR, DIPPED MICA: 10 pf, 5%	DM10-100J	84171
CR1	DIODE, VARICAP	V27E	01281
CR2	DIODE	1N462A	07688
CR3	DIODE	1N198	07688
CR4	DIODE	1N753A	07688
CR5	Same as CR3		
CR6	NOT USED		
CR7	NOT USED		
CR8	Same as CR2		
CR9	Same as CR3		
CR10	Same as CR3		
E1	FEEDTHRU, TEFLON	SFU-16	04013
E2	Same as E1		
E3	Same as E1		
E4	Same as E1		
E5	Same as E1		
E6	Same as E1		
E7	NOT USED		
E8	Same as E1		
E9	Same as E1		
E10	Same as E1		
E11	Same as E1		
FB1	FERRITE BEAD	56-590-65/4A	02114
FB2	Same as FB1		
FB3	Same as FB1		
FB4	Same as FB1		
FB5	Same as FB1		
FB6	Same as FB1		
FB7	Same as FB1		
FB8	Same as FB1		
FB9	Same as FB1		
FB10	Same as FB1		
FB11	Same as FB1		

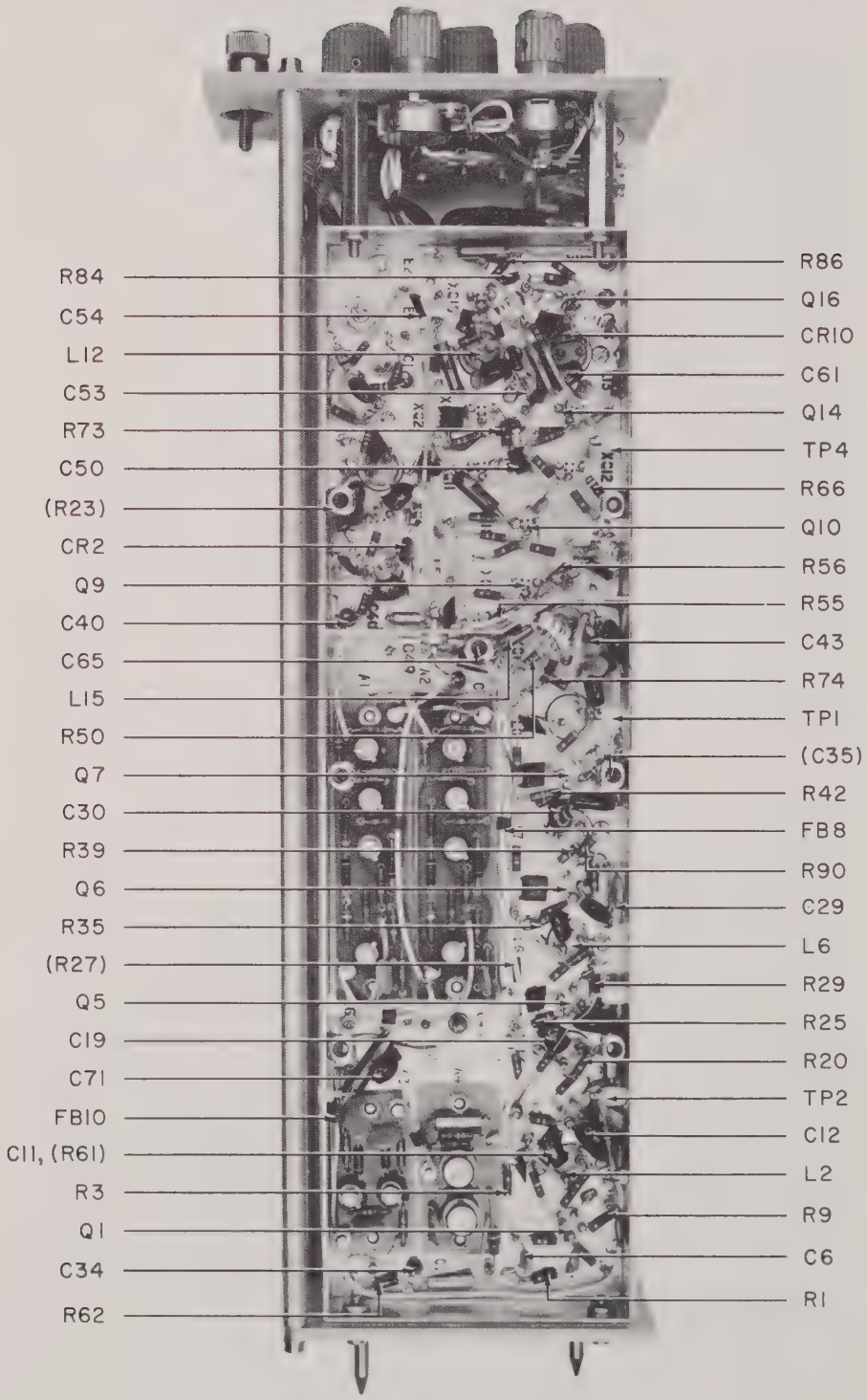


Figure 5-3. Type IFD-4000B IF Demodulator, Right-Side View

Ref. Desig.	Description	Vendor Part No.	Vendor Code
J1	CONNECTOR, RECEPTACLE, SUB-MINIATURE	27-9	74868
J2	Same as J1		
L1	COIL, VARIABLE	1113	14632
L2	COIL, VARIABLE	1472-3	14632
L3	COIL, VARIABLE	1472-1	14632
L4	COIL, VARIABLE	1472-2	14632
L5	Same as L4		
L6	Same as L2		
L7	Same as L4		
L8	Same as L2		
L9	COIL, FIXED: 2.7 μh	210-11	99848
L10	COIL, FIXED	1131-37	14632
L11	Same as L10		
L12	Same as L2		
L13	Same as L2		
L14	COIL, FIXED	1131-41	14632
L15	Same as L10		
L16	Same as L10		
L17	Same as L14		
L18	COIL, FIXED: 5.6 μh	214-11	99848
P1	CONNECTOR, PLUG: Multi-pin, w/2 coaxial inserts #DM53740-5001, p/o W1 and W2	DBM-17W-2P	71468
P2	CONNECTOR, PLUG, SUB-MINIATURE, p/o W1	27-7	74868
P3	Same as P2, p/o W2		
Q1	TRANSISTOR	2N2708	07688
Q2	TRANSISTOR	2N706	07688
Q3	Same as Q1		
Q4	Same as Q2		
Q5	Same as Q1		
Q6	Same as Q1		
Q7	Same as Q1		
Q8	Same as Q1		
Q9	Same as Q2		
Q10	Same as Q2		
Q11	Same as Q2		
Q12	Same as Q2		
Q13	Same as Q2		

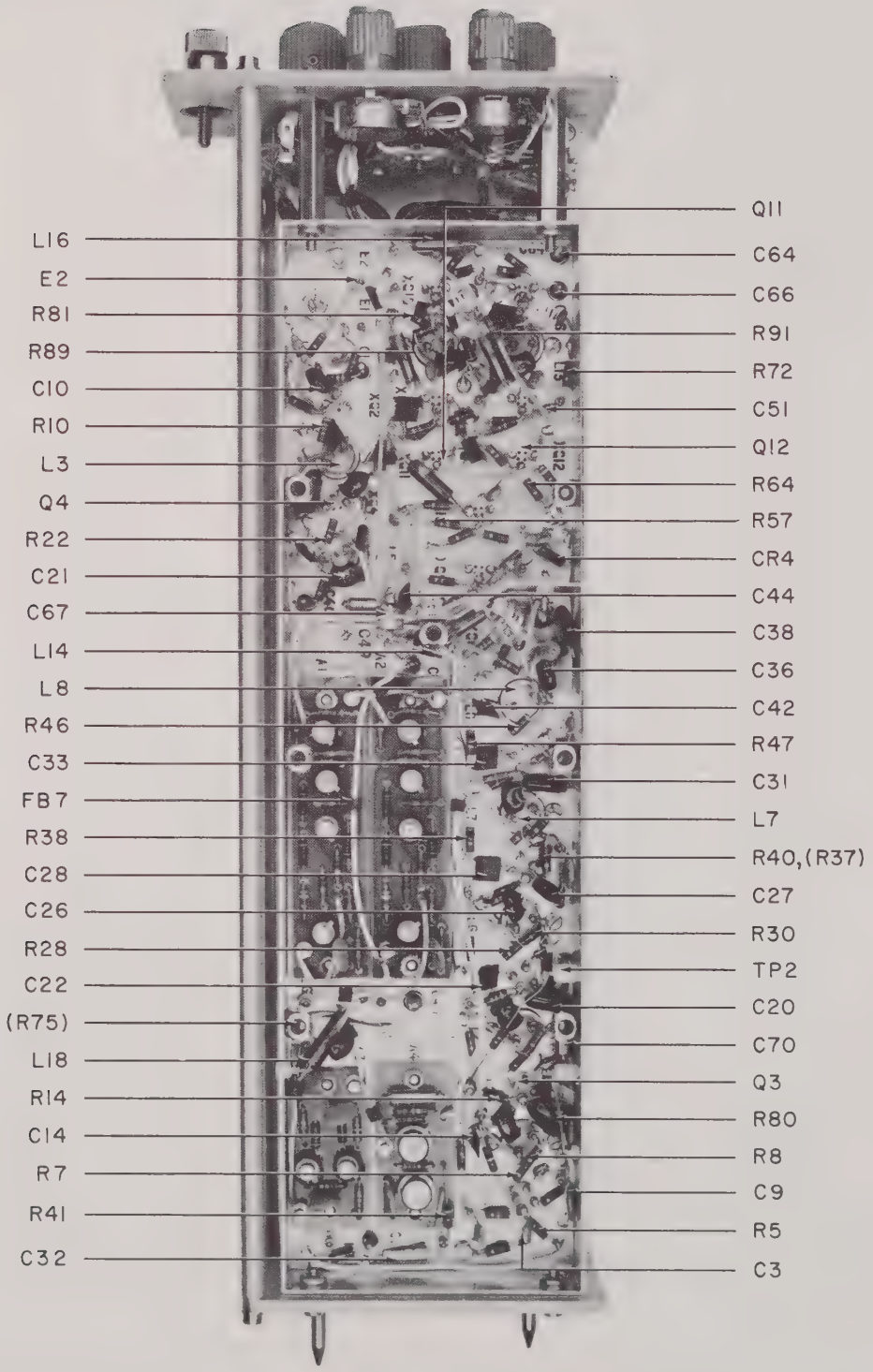


Figure 5-4. Type IFD-4000B IF Demodulator, Right-Side View

Ref. Desig.	Description	Vendor Part No.	Vendor Code
Q14	Same as Q2		
Q15	Same as Q2		
Q16	Same as Q2		
R1	RESISTOR, FIXED, COMPOSITION: 51Ω, 5%, 1/4W	CB5105	01121
R2	RESISTOR, FIXED, COMPOSITION: 240K, 5%, 1/4W	CB2445	01121
R3	RESISTOR, FIXED, COMPOSITION: 3K, 5%, 1/4W	CB3025	01121
R4	RESISTOR, FIXED, COMPOSITION: 12K, 5%, 1/4W	CB1235	01121
R5	RESISTOR, FIXED, COMPOSITION: 5.1K, 5%, 1/4W	CB5125	01121
R6	RESISTOR, FIXED, COMPOSITION: 1K, 5%, 1/4W	CB1025	01121
R7	RESISTOR, FIXED, COMPOSITION: 47Ω, 5%, 1/4W	CB4705	01121
R8	RESISTOR, FIXED, COMPOSITION: 9.1K, 5%, 1/4W	CB9125	01121
R9	RESISTOR, FIXED, COMPOSITION: 22Ω, 5%, 1/4W	CB2205	01121
R10	RESISTOR, FIXED, COMPOSITION: 43K, 5%, 1/4W	CB4335	01121
R11	Same as R10		
R12	RESISTOR, FIXED, COMPOSITION: 33Ω, 5%, 1/4W	CB3305	01121
R13	RESISTOR, FIXED, COMPOSITION: 2.2K, 5%, 1/4W	CB2225	01121
R14	RESISTOR, FIXED, COMPOSITION: 15K, 5%, 1/4W	CB1535	01121
R15	Same as R5		
R16	Same as R6		
R17	Same as R7		
R18	Same as R6		
R19	RESISTOR, FIXED, COMPOSITION: 100Ω, 5%, 1/4W	CB1015	01121
R20	RESISTOR, FIXED, COMPOSITION: 6.8K, 5%, 1/4W	CB6825	01121
R21	Same as R9		
R22	Same as R4		
R23	Same as R5		
R24	Same as R6		
R25	RESISTOR, FIXED, COMPOSITION: 24K, 5%, 1/4W	CB2435	01121
R26	Same as R5		
R27	Same as R19		
R28	Same as R7		
R29	Same as R6		
R30	Same as R3		
R31	Same as R9		
R32	RESISTOR, FIXED, COMPOSITION: 680Ω, 5%, 1/4W	CB6815	01121
R33	RESISTOR, VARIABLE, COMPOSITION: 1K, 10%, 1/4W	70-08800	37942

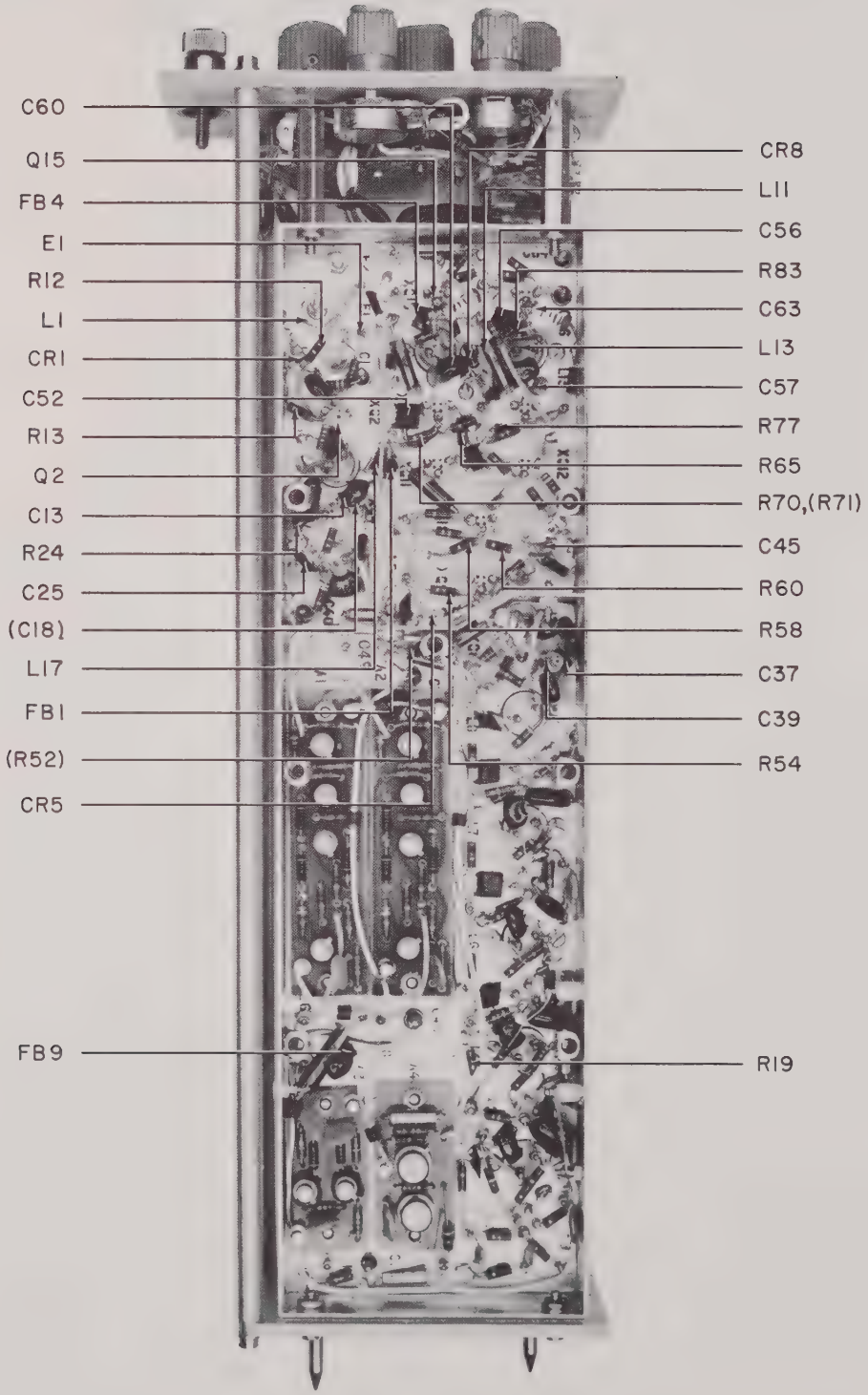


Figure 5-5. Type IFD-4000B IF Demodulator, Right-Side View

Ref. Desig.	Description	Vendor Part No.	Vendor Code
R34	RESISTOR, FIXED, COMPOSITION: 470Ω, 5%, 1/4W	CB4715	01121
R35	Same as R14		
R36	Same as R5		
R37	Same as R6		
R38	Same as R19		
R39	Same as R7		
R40	Same as R9		
R41	RESISTOR, FIXED, COMPOSITION: 2.4K, 5%, 1/4W	CB2425	01121
R42	RESISTOR, FIXED, COMPOSITION: 11K, 5%, 1/4W	CB1135	01121
R43	Same as R5		
R44	RESISTOR, VARIABLE, COMPOSITION: 10K, 10%, 1/2W	LW23562	71450
R45	RESISTOR, FIXED, COMPOSITION: 430Ω, 5%, 1/4W	CB4315	01121
R46	Same as R7		
R47	Same as R19		
R48	RESISTOR, FIXED, COMPOSITION: 100K, 5%, 1/4W	CB1045	01121
R49	RESISTOR, FIXED, COMPOSITION: 10K, 5%, 1/4W	CB1035	01121
R50	RESISTOR, FIXED, COMPOSITION: 91K, 5%, 1/4W	CB9135	01121
R51	Same as R5		
R52	RESISTOR, FIXED, COMPOSITION: 1.5K, 5%, 1/4W	CB1525	01121
R53	RESISTOR, FIXED, COMPOSITION: 560Ω, 5%, 1/4W	CB5615	01121
R54	Same as R4		
R55	Same as R5		
R56	RESISTOR, FIXED, COMPOSITION: 510Ω, 5%, 1/4W	CB5115	01121
R57	Same as R4		
R58	Same as R5		
R59	Same as R5		
R60	Same as R9		
R61	RESISTOR, FIXED, COMPOSITION: 130K, 5%, 1/4W	CB1345	01121
R62	RESISTOR, FIXED, COMPOSITION: 20K, 5%, 1/4W	CB2035	01121
R63	Same as R4		
R64	Same as R5		
R65	Same as R53		
R66	RESISTOR, FIXED, COMPOSITION: 390Ω, 5%, 1/4W	CB3915	01121
R67	Same as R4		
R68	Same as R56		
R69	RESISTOR, FIXED, COMPOSITION: 200Ω, 5%, 1/4W	CB2015	01121

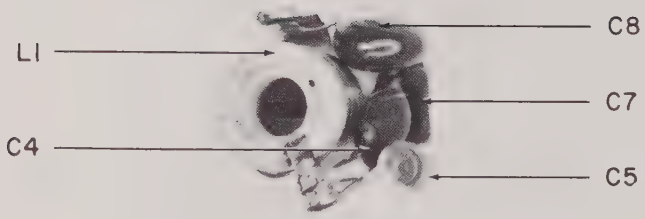


Figure 5-6. BFO Assembly, Component Locations

Ref. Desig.	Description	Vendor Part No.	Vendor Code
R70	Same as R4		
R71	Same as R5		
R72	Same as R9		
R73	Same as R9		
R74	Same as R49		
R75	RESISTOR, FIXED, COMPOSITION: 91Ω, 5%, 1/4W	CB9105	01121
R76	Same as R4		
R77	Same as R5		
R78	Same as R56		
R79	Same as R69		
R80	Same as R49		
R81	RESISTOR, FIXED, COMPOSITION: 4.3K, 5%, 1/4W	CB4325	01121
R82	Same as R49		
R83	Same as R49		
R84	RESISTOR, FIXED, COMPOSITION: 6.2K, 5%, 1/4W	CB6225	01121
R85	Same as R84		
R86	RESISTOR, FIXED, COMPOSITION: 3.6K, 5%, 1/4W	CB3625	01121
R87	Same as R86		
R88	RESISTOR, FIXED, COMPOSITION: 13K, 5%, 1/4W	CB1335	01121
R89	RESISTOR, FIXED, COMPOSITION: 8.2K, 5%, 1/4W	CB8225	01121
R90	Same as R86		
R91	Same as R49		
R92	Same as R89		
S1	SWITCH, ROTARY: 4 pole, 2-12 position	399225A	81716
S2	SWITCH, ROTARY: 1 pole, 2-12 position	399217A	81716
S3	Same as S2		
TP1	TEST POINT	TJ-6	04013
TP2	Same as TP1		
TP3	Same as TP1		
TP4	Same as TP1		
W1	CABLE AND CONNECTOR ASSEMBLY	30020-118	14632
W2	CABLE AND CONNECTOR ASSEMBLY	30020-119	14632

5.4.2 Type 10967 Video Amplifier REF DESIG PREFIXES A1 AND A2

Ref. Desig.	Description	Vendor Part No.	Vendor Code
C1	CAPACITOR, CERAMIC DISC: .005 μf, 20%	SM	91418
C2	Same as C1		
CR1	DIODE	1N462A	07688
CR2	Same as CR1		
CR3	Same as CR1		
Q1	TRANSISTOR	2N3251	07688
Q2	TRANSISTOR	2N706	07688
Q3	Same as Q1		
Q4	Same as Q2		
R1	RESISTOR, FIXED, COMPOSITION: 3M, 5%, 1/4W	CB3055	01121
R2	RESISTOR, FIXED, COMPOSITION: 100K, 5%, 1/4W	CB1045	01121
R3	RESISTOR, FIXED, COMPOSITION: 1.1K, 5%, 1/4W	CB1125	01121
R4	RESISTOR, FIXED, COMPOSITION: 11K, 5%, 1/4W	CB1135	01121
R5	RESISTOR, FIXED, COMPOSITION: 27Ω, 5%, 1/4W	CB2705	01121
R6	RESISTOR, FIXED, COMPOSITION: 3.9K, 5%, 1/4W	CB3925	01121
R7	RESISTOR, FIXED, COMPOSITION: 20Ω, 5%, 1/4W	CB2005	01121
R8	Same as R7		
R9	RESISTOR, FIXED, COMPOSITION: 620Ω, 5%, 1/4W	CB6215	01121
R10	RESISTOR, FIXED, COMPOSITION: 680Ω, 5%, 1/4W	CB6815	01121

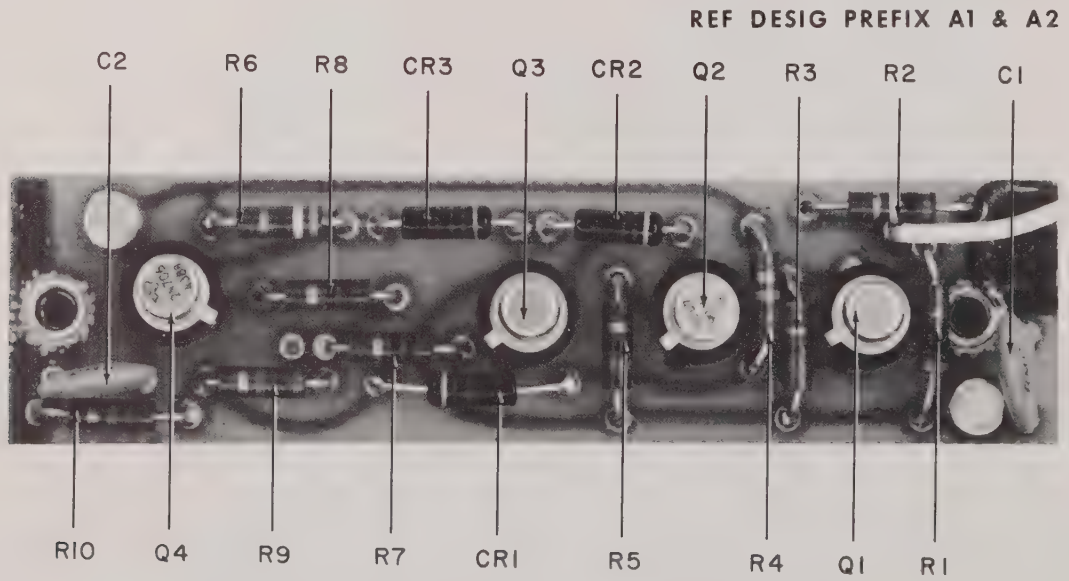


Figure 5-7. Part 10967 Video Amplifier, Component Locations

5.4.3 Type 10951 Video Amplifier REF DESIG PREFIX A3

Ref. Desig.	Description	Vendor Part No.	Vendor Code
C1	CAPACITOR, CERAMIC DISC: .005 μf, 20%	SM	91418
C2	Same as C1		
CR1	DIODE	1N462A	07688
CR2	Same as CR1		
Q1	TRANSISTOR	2N706	07688
Q2	TRANSISTOR	2N3251	07688
R1	RESISTOR, FIXED, COMPOSITION: 12K, 5%, 1/4W	CB1235	01121
R2	Same as R1		
R3	RESISTOR, FIXED, COMPOSITION: 6.8Ω, 5%, 1/4W	CB68G5	01121
R4	Same as R3		

REF DESIG PREFIX A3

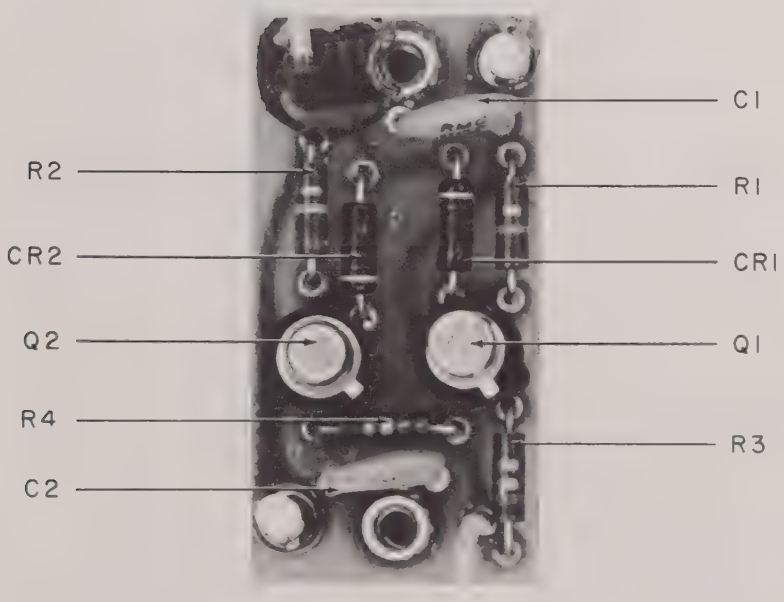


Figure 5-8. Part 10951 Video Amplifier, Component Locations

5.4.4 Type 11019 AGC Amplifier REF DESIG PREFIX A4

Ref. Desig.	Description	Vendor Part No.	Vendor Code
C1	CAPACITOR, ELECTROLYTIC: 3.3 μf, 10%, 35V	150D335X9035B2	56289
C2	CAPACITOR, CERAMIC DISC: .005 μf, 20%	SM	91418
Q1	TRANSISTOR	2N697	07688
Q2	Same as Q1		
R1	RESISTOR, FIXED, COMPOSITION: 30K, 5%, 1/4W	CB3035	01121
R2	RESISTOR, FIXED, COMPOSITION: 33K, 5%, 1/4W	CB3335	01121
R3	RESISTOR, FIXED, COMPOSITION: 470Ω, 5%, 1/4W	CB4715	01121

REF DESIG PREFIX A4

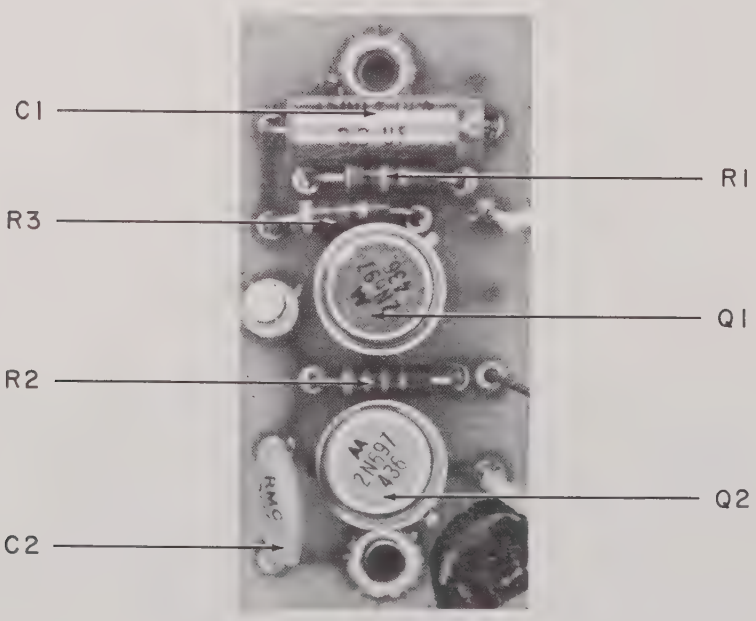


Figure 5-9. Part 11019 AGC Amplifier, Component Locations

SECTION VI

SCHEMATICS

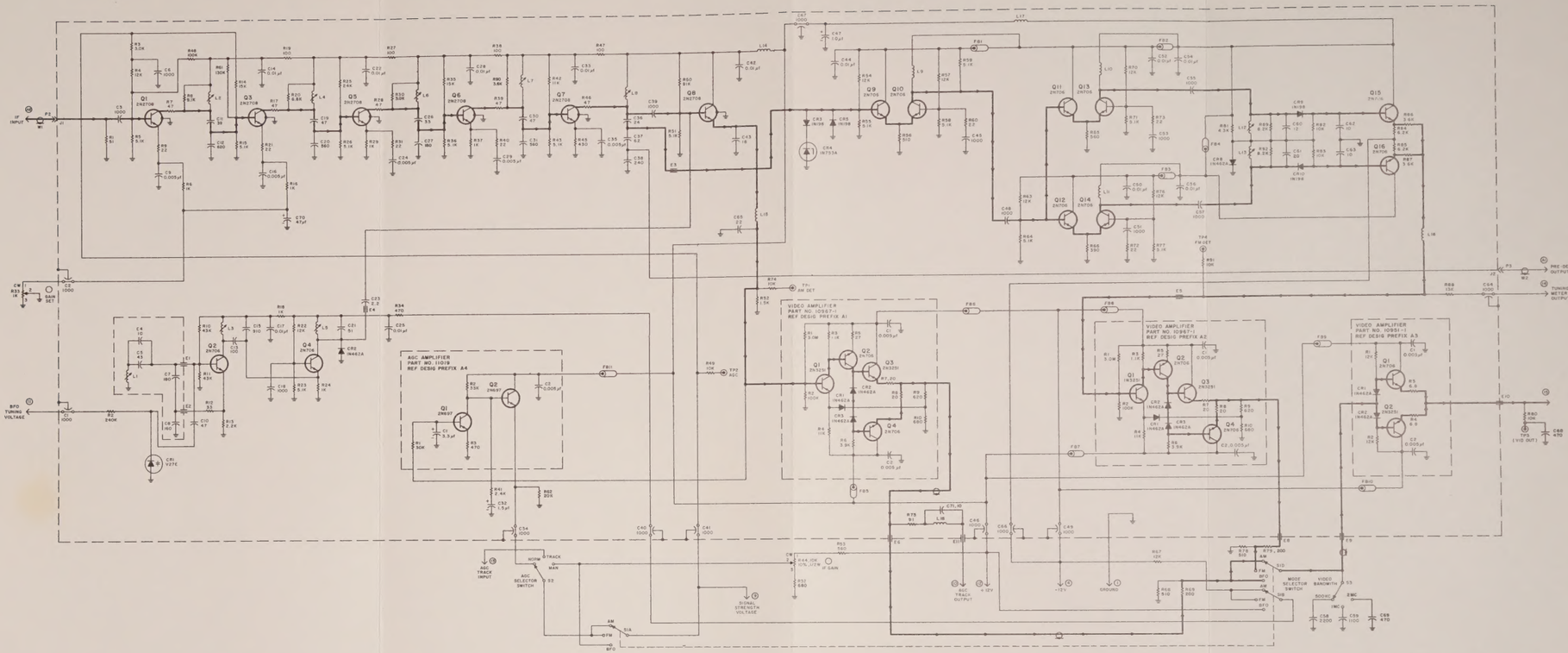


Figure 6-1. Type IFD-4000B IF Demodulator, Schematic Diagram